Tutorial 1

Introduction to AI

1. Read chapter 1 of Russell and Norvig's Artificial Intelligence: A modern approach and answer the items below in connection with the Introduction lecture.
   (a) Define the following terms
      1. Intelligence
      2. Artificial Intelligence
      3. Agent
      4. Rationality
      5. Logical Reasoning
   (b) Turing in his original paper[1] discusses several objections to his proposed enterprise and his test for intelligence. Answer:
      1. Which objections still carry weight?
      2. Are his refutations valid?
      3. Can you think of new objections arising from developments since he wrote the paper?
      4. In the paper, he predicts that, by the year 2000, a computer will have a 30% chance of passing a five-minute Turing Test with an unskilled interrogator. What chance do you think a computer would have today? In another 50 years?
   (c) To what extent do the following computer systems embed artificial intelligence:
      1. Supermarket bar code scanners
      2. Web search engines
      3. Voice-activated telephone menus
      4. Internet routing algorithms that respond dynamically to the state of the network.
   (d) Why would evolution tend to result in systems that act rationally? What goals are such systems designed to achieve?
   (e) Is AI a science, or is it engineering? Or neither, or both? Explain.
   (f) "Surely computers cannot be intelligent—they can do only what their programmers tell them." Is the latter statement true, and does it imply the former?
   (g) "Surely animals cannot be intelligent—they can do only what their genes tell them." Is the latter statement true, and does it imply the former?
   (h) "Surely animals, humans, and computers cannot be intelligent—they can do only what their constituent atoms are told to do by the laws of physics." Is the latter statement true, and does it imply the former?

[1] http://phil415.pbworks.com/f/TuringComputing.pdf

Agents

2. Read chapter 2 of Russell and Norvig's *Artificial Intelligence: A modern approach* and answer the items below in connection with the Intelligent Agents lecture.
   (a) For each of the following assertions, say whether it is true or false and support your answer with examples or counterexamples where appropriate:
      1. An agent that senses only partial information about the state cannot be perfectly rational.
      2. There exist task environments in which no pure reflex agent can behave rationally.
      3. There exists a task environment in which every agent is rational.
      4. The input to an agent program is the same as the input to the agent function.
      5. Every agent function is implementable by some program/machine combination.
      6. Suppose an agent selects its action uniformly at random from the set of possible actions. There exists a deterministic task environment in which this agent is rational.
      7. It is possible for a given agent to be perfectly rational in two distinct task environments.
      8. Every agent is rational in an unobservable environment.
      9. A perfectly rational poker-playing agent never loses.
   (b) For each of the following activities, give a PEAS (i.e. the types of environments) description of the task environment and characterize it in terms of the properties listed in Section 2.3.2.
      1. Shopping for used AI books on the Internet
      2. Bidding on an item at an auction.
   (c) This exercise explores the differences between agent functions and agent programs.
      1. Can there be more than one agent program that implements a given agent function? Give an example, or show why one is not possible.
      2. Are there agent functions that cannot be implemented by any agent program?
      3. Given a fixed machine architecture, does each agent program implement exactly one agent function?
      4. Given an architecture with n bits of storage, how many different possible agent programs are there?
      5. Suppose we keep the agent program fixed but speed up the machine by a factor of two. Does that change the agent function?
   (d) Discuss possible agent programs for each of the following stochastic environments:
      1. Murphy's law: twenty-five percent of the time, the Suck action fails to clean the floor if it is dirty and deposits dirt onto the floor if the floor is clean. How is your agent program affected if the dirt sensor gives the wrong answer 10% of the time?
      2. Small children: At each time step, each clean square has a 10% chance of becoming dirty. Can you come up with a rational agent design for this case?